Goddard Procedural Requirements (GPR)

DIRECTIVE NO.	GPR 1700.7A	**APPROVED BY Signature:**	*Original signed by*
EFFECTIVE DATE:	November 25, 2013	**NAME:**	Robert Strain
EXPIRATION DATE:	January 12, 2017	**TITLE:**	Director

COMPLIANCE IS MANDATORY

Responsible Office: 360/Safety Division

Title: Electrical Safety

PREFACE

P.1 PURPOSE

This directive sets forth the minimum electrical safety requirements within the framework of Goddard Space Flight Center's (GSFC) safety policies and constraints. It is primarily for use by qualified persons who routinely engage in facility-related electrical work; however, it also applies to electrical equipment in office and laboratory environments. It does not apply to spacecraft-related power systems. It is not an instruction manual for untrained personnel, nor is it a substitute for detailed procedures judged necessary for the safe conduct of a specific electrical task by individuals and their supervisors.

P.2 APPLICABILITY

This directive applies to all GSFC civil servants, contractors, tenants, and other persons involved in the design, construction, operation, maintenance, research and development of nonspacecraft electrical/electronic systems on GSFC property, including all permanent and temporary sites. This includes nonfacility-related electrical operations, such as extension cords and temporary wiring setups. Electrical/electronic systems and hardware that are 50 volts AC (rms)/DC or less are exempt from the requirements of this GPR.

The term "Safety Office" applies equally to the safety offices at both Greenbelt (Code 360) and Wallops Flight Facility (Code 803).

P.3 AUTHORITY

a. Occupational Safety and Health Administration (OSHA) 1910, General Industry Standards
b. OSHA 1926, Construction Industry Regulations
c. National Fire Protection Association (NFPA) 70E, Standard for Electrical Safety in the Workplace

P.4 REFERENCES

a. NFPA 70, National Electrical Code.
b. NFPA 70B, Recommended Practice for Electrical Equipment Maintenance.
c. NFPA 70E Standard for Electrical Safety in the Workplace
d. NPR 8715.3, NASA General Safety Program Requirements.

e. GPR 1700.1, Occupational Safety Program at Goddard Space Flight Center.
f. GPR 1700.5, Control of Hazardous Energy (Lockout/Tagout).
g. GPR 1700.6, Confined Space Program at GSFC.
h. GPR 8719.1, Lifting Devices and Equipment (LDE) Certifications and Operations
i. GSFC Form 23-83, Energized Electrical Work Permit.

P.5 CANCELLATION

GPR 1700.7, Electrical Safety

P.6 SAFETY

As described throughout this directive.

P.7 TRAINING

Civil Servant and Contractor Supervisors shall ensure that all personnel under their authority are qualified for the type of activity/operation required to perform their electrical work safely and effectively. The qualified person(s) (see Section 2.1) shall be trained in and knowledgeable of the installation, construction and/or operation and maintenance of electrical equipment and be able to recognize and avoid the electrical hazards that are present with respect to equipment or work procedures. Training shall meet, at minimum, requirements set forth in NASA, NFPA, OSHA, and national consensus electrical standards.

Civil service and contractor supervisors shall maintain copies of current training records, and shall identify training requirements for each of their employees tasked to perform electrical activities.

See Section 3 for specific Electrical Safety Training Requirements.

P.8 RECORDS

Record Title	Record Custodian	Retention
Records of Electrical Safety Training	Office of Human Capital Management	NRRS 3/33G1, 2* – Destroy 5 years after employee discontinues or completes training.
Physician Report That Evaluates the Employee's Ability to Conduct High Voltage Work.	Health Unit	NRRS 1/127A* – Retain until employee is transferred or separated. Upon transfer, ship medical record to medical office of new assignment. Within 30 days after separation, transfer to National Personnel Records Center.

Energized Electrical Work Permit Form 23-83	Organizations Conducting Electrical Operations and Safety Office	NRRS 1/123* – Destroy after organization determines analysis is not longer relevant.

Waiver/Deviation of Standards Documentation	Safety Office	* NRRS 1/120E - Retire to FRC when the risk/safety assessment/analysis is complete/inactive. Destroy when 15 years old.
Inspection Records	Organizations Conducting Electrical Operations	29 CFR 1960.73 - Records and reports shall be retained for 3 years following the end of the fiscal year to which they relate.
Building Drawings	FMD	* NRRS 8/48B2 - *Permanent* May retire to FRC 2 Years after disposal Of installation Transfer to NARA 25 years after disposal of installation -.
Annual Electrical Safety Program Survey Reports	Safety Office	29 CFR 1960.73 - Records and reports shall be retained for 3 years following the end of the fiscal year to which they relate.

**NRRS – NASA Records Retention Schedules (NPR 1441.1)*

P.9 METRICS

The Safety Office will gather metrics from the following activities and analyze them for trends and lessons learned:

a. Audits/inspections of electrical safety operations to ensure organizational program compliance; and

b. Review close calls, lost-time incidents, and property damage due to electrical mishaps in order to prevent future occurrences.

In addition, the Electrical Safety Committee (see Section 1.9) shall report to the Assistant Director for Safety and Security on the effectiveness of the Electrical Safety Program as determined by periodic electrical safety assessments and evaluations.

P.10 DEFINITIONS

Following are some key definitions related to electrical safety. Many additional related definitions are contained within referenced documents such as the NFPA 70, National Electrical Code (NEC), NFPA 70E, Standard for Electrical Safety in the Workplace, and the National Electrical Safety Code (NESC).

Unless expressly stated elsewhere herein, the following terms shall have the meanings indicated below:

a. Barrier – A physical obstruction that is intended to prevent contact with exposed energized electrical conductors or circuit parts. Barriers can be temporary or permanent.
b. De-energized – Free from any electrical connection to a source of potential difference and from electrical charge; not having a potential different from that of the earth.
c. Electrical Hazard – A dangerous condition such that inadvertent or unintentional contact or equipment failure can result in shock, arc flash-burn, thermal burn, or blast.
d. Electrical Quality Assurance Representative – An individual who is authorized by line management to perform electrical inspections for code compliance and quality.
e. Electrical Safety Officer – A collateral-duty position that refers to an identified person who by ensures the organization complies with electrical safety standards.
f. Electrically Safe Work Condition – A state in which the conductor or circuit part to be worked on or near has been disconnected from energized parts, locked and tagged in accordance with GPR 1700.5.
g. Electrical Work – (1) Working on or near energized electrical parts; (2) Assembly or fabrication of potentially energized electrical equipment, (3) Installation , maintenance, and repair of electrical conductors, equipment, and systems over 50 volts.
h. Energized – Electrically connected to or having a voltage source. NOTE: "De-energized" parts that have not been placed into an electrically safe work condition are considered energized.
i. Energized Electrical Work Permit (EEWP) – A Director Of approved written permit (GSFC Form 23-83) required by the National Fire Protection Association (NFPA) 70E for non-routine work on energized equipment 50v and above that cannot be placed in an electrically safe work condition.
j. Exposed (as applied to energized parts) – Capable of being inadvertently touched or approached nearer than a safe distance by a person, especially parts that are not suitably guarded, isolated, or insulated.
k. Facility – Relating to Center infrastructure and/or utilities. The term facility does not include specific test equipment such as thermal/vac chambers or test cells.
l. Field Verified – (as applied to electrical configuration controlled drawings): Verification that the drawing accurately depicts the configuration of installed systems or equipment by visual comparison and by point-to-point wire checks prior to placing the system into service. Point-to-point wire checks require ringing out or talking down the wiring between points of termination and are usually done during installation.
m. Flash Hazard – A dangerous condition associated with the release of energy caused by an electric arc.
n. Functionally Verified (as applied to electrical configuration controlled drawings) – Verification that the drawing accurately depicts the configuration of a functional system or equipment by visual comparison.
o. Grounded – Connected to earth or to some conducting body that serves in place of the earth.

p. Guarded – Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach or contact by persons or objects to a point of danger.
q. Hazard Analysis – The identification and evaluation of existing and potential electrical hazards and the recommend mitigation for the hazard sources found
r. Live Part – An energized conductive component.
s. Lockout/Tagout (LOTO) – The full procedure of determining what is required to make a system safe; the action of making the system safe; and the placing of locks, locking devices, and "Do Not Operate" tags to preclude changing from the safe condition. See GPR 1700.5 for LOTO requirements.
t. Qualified Person – One who has been trained in and demonstrates adequate knowledge of the installation, construction, and/or operation and maintenance of electrical equipment and has received safety training on the hazards involved.
u. Service Point – The point of connection between the facilities of the serving utility and the premises wiring. Service points for buildings at GSFC are defined as the line side of the first service disconnecting means for the facility.
v. Shock Hazard – A dangerous condition associated with the possible release of energy caused by contact or approach to live parts.
w. Two Person Rule – The practice of employing a second electrically qualified person to directly observe the electrical work of a Qualified Person working on, or near (unguarded) energized electrical equipment.
x. Unqualified Person – Individuals, who do not meet the requirements of Section 2.1, but work with or use electrical equipment. They are protected from risk of exposure to electrical hazards by the presence of protective barriers. Unqualified persons shall be trained in, and familiar with, any electrical safety-related practices necessary for their safety.
y. Voltage (of a circuit) – The greatest root-mean-square (rms) (effective) difference of electrical potential between any two conductors of the circuit concerned.
z. Voltage, High – Electric power system and equipment operating at greater than 600 volts Nominal and above.
aa. Voltage, Low – Electric power system and equipment operating at less than or equal to 600 volts Nominal
bb. Working on (live parts) – Coming in contact with exposed energized electrical conductors or circuit parts with the hands, feet, or other body parts, with tools, probes, or with test equipment, regardless of the personal protective equipment a person is wearing.

P.11 ACRONYMS

EEWP	Energized Electrical Work Permit
ESC	Electrical Safety Committee
ESO	Electrical Safety Officer
FMB	Facilities Management Branch
FMD	Facilities Management Division
FRC	Federal Records Center
GPR	Goddard Procedural Requirements
NARA	National Archive and Records Administration
NEC	National Electric Code (NFPA 70E)

NFPA	National Fire Protection Association
NRTL	Nationally Recognized Testing Laboratory
OJT	On-the-Job Training
OSHA	Occupational Health and Safety Administration
PPE	Personal Protective Equipment
WFF	Wallops Flight Facility

PROCEDURES

In this document, a requirement is identified by "shall," a good practice by "should," permission by "may" or "can," expectation by "will" and descriptive material by "is."

1. RESPONSIBILITIES

Assistant Director for Safety and Security (ADSS) shall ensure their responsibilities as defined in GPR 1700.1 are met and:

a) Appoint the chair of the Electrical Safety Committee (ESC).

1.2 Directors Of shall:

a. Ensure that written Hazard Analysis and Operational Procedures involving the use, exposure to, generation of, or control of electrical safety hazards are reviewed annually and updated as needed;
b. Ensure that personnel are provided appropriate training and workplace orientation to identify electrical hazards and the protective measures required for their safety;
c. Ensure that personnel are notified of any changes or modifications to policies or systems used to control electrical safety hazards;
d. Directors Of whose workers engage in electrical work shall appoint Electrical Safety Officer(s) (ESO) to serve as their Directorate's representative to the Electrical Safety Committee (ESC) and shall ensure that appropriate time is allotted and resources are provided for ESOs to perform their assigned duties; and
e. Be final approver for Energized Electrical Work Permits (EEWPs) or designate an authorized representative as such.

1.3 Division Chiefs

Division Chiefs whose workers engage in electrical work shall be responsible for ensuring that safe electrical work is accomplished within their area of responsibility, and:

a. Ensure full implementation of electrical safety requirements throughout their organizations;
b. Ensure full implementation of the applicable requirements of this GPR; and
c. Address and resolve deficiencies noted during electrical inspections.

1.4 Supervisors

Supervisors are responsible for ensuring that the requirements herein are adhered to in the design, construction, modification, operation, and maintenance of electrical systems. Supervisors who authorize electrical work (e.g., area work supervisors, team leaders, foremen, facility managers, project leaders, etc.) shall:

a. Ensure that safe work is accomplished within their area(s) of responsibility;
b. Review and approve Task Safety Analysis and hazardous operating procedures for working with energized equipment;
c. Ensure that subordinate workers are qualified and have received training as required by this GPR and that this training is documented;
d. Ensure prime and subcontractors are provided with descriptions of site-specific hazards for proposed work;
e. Ensure that workers have the required tools, PPE, and other resources to perform their work safely;
f. Authorize the performance of energized electrical work using approved Energized Electrical Work Permits (EEWPs) as applicable (see Section 4.2); and
g. Report all mishaps or close calls as described in GPR 8621.1.

1.5 All Implementing Organizations

Organizations that engage in electrical work at a GSFC-managed site, or site controlled by the GSFC including Contractors, inclusive of lower tier subcontractors, and consultants, shall implement the requirements contained in this GPR. This shall primarily be done by defining, establishing, and understanding individual accountabilities, authorities, interfaces, and responsibilities as defined in this document. Furthermore, each organization shall:

a. Incorporate and implement the requirements of this GPR into the organization's Safety and Health Plan as required by Agency Contract Clause (for contractors);
b. Conform with lockout/tagout requirements and procedures as described in GPR 1700.5;
c. Implement Quality Control/Quality Assurance functions if work can potentially impact flight hardware or critical test equipment (or if appropriate to operational needs) to monitor and ensure that electrical work performed by the organization is performed in accordance with OSHA, NFPA, and GSFC standards. Quality control/Quality assurance functions shall include:
    - Inspection of electrical installations as covered by the National Electrical Code (NEC);
    - Maintenance of records of all electrical inspections, including the date of such inspections, a summary of any violations found to exist, and a record of the final disposition of all violations;
    - Verification that safe electrical work practices are followed; and
    - Verification that electrical systems are de-energized and placed in an electrically safe work condition as required in GPR 1700.5.
d. Respond to ESC-initiated assessments and action items;
e. Submit to the Facilities Management Division (FMD) updates to Facility-related electrical systems drawings to reflect changes or modifications as a result of the work performed by the organization;
f. At the Wallops Flight Facility, all electrical utility / power distribution electrical changes will be performed by the Wallops Integrated Institutional Contract (WICC) or by a Facilities Management Branch (FMB) approved contract; and

g. Develop Pre-Emergency Outage Plans (as appropriate) to address realistic scenarios in order to prevent the need for exposing workers to energized circuits during emergency situations.

1.6 Safety Office

The Safety Office shall:

a. Serve as secretary of the ESC (Code 360);
b. Provide assistance to organizations for assessing GSFC compliance to the requirements of this GPR and electrical codes;
c. In conjunction with the Office of Human Capital Management, identify adequate electrical safety training resources;
d. Review contractor health and safety plans to ensure that the applicable provisions of this GPR are properly incorporated;
e. Ensure contractor health and safety plans meet the requirements of NPR 8715.3, section 9.4.2 and recommend approval to the Contracting Officer;
f. Conduct annual organizational electrical safety program reviews to ensure operating activities are complying with requirements; and
g. Conduct periodic inspections of job sites to ensure work activities comply with the requirements of this GPR.

1.7 Organizations Procuring Electrical Work shall:

a. Include the requirements of this GPR in all contracts for the design, construction, operation and maintenance of facilities, and electrical systems operating under the auspices of GSFC, or on GSFC property;
b. Ensure contractor solicitations meet the requirements of NPR 8715.3, section 9.4.1; and
c. Take necessary remedial action when the contractor is in violation of the requirements of this GPR or a deficiency in performance of work impacting a contractual provision is identified.

1.8 Facilities Management Division (FMD)

The Facilities Management Division shall:

a. Meet the requirements set forth in section 1.5 of this GPR;
b. Manage the Outage Approval Process;
c. Develop and maintain systems drawings for the Center in accordance with Section 5.2;
d. Authorize connection of premises, buildings, or additions to the source of electrical supply, and authorize connection of equipment to the source of electrical supply; and
e. Develop and implement design standards for electrical work and electrical systems operating under the auspices of GSFC, or on GSFC property, including all permanent and temporary sites.

1.9 Electrical Safety Committee (ESC)

The ESC shall be composed of a representative from each Directorate and WFF performing work governed by this GPR. The committee shall:

a. Develop a Committee Charter that describes the purpose, chairmanship, membership, goals/objectives, responsibilities, etc.;
b. Assist in the implementation of the GSFC Electrical Safety Program, and in the maintenance of this GPR and its companion documents;
c. Evaluate and recommend the adoption of new or revised standards, codes, and requirements for electrical work;
d. Provide a forum for electrical workers to address and resolve workplace electrical safety issues;
e. Evaluate the impact of electrical safety requirements or interpretations;
f. Review mishaps and close calls that involve electrical issues and participate in the root-cause analyses; and
g. Report to the Assistant Director for Safety and Security on the effectiveness of the Electrical Safety Program as determined by periodic electrical safety assessments and evaluations.

1.10 Electrical Safety Officer (ESO)

Collateral-duty ESO(s) will be appointed by each Directorate engaged in electrical work covered by this GPR. Each ESO shall:

a. Assist in the development of and provide concurrence with EEWPs initiated by their organization;
b. Facilitate corrective actions regarding work performed under the direction of their organization, including stopping work or activities that do not meet GSFC electrical safety requirements;
c. Provide clarification of codes, standards, and regulations within their organization(s), and request formal interpretations through the ESC as necessary.

1.11 Electrical Quality Assurance (QA) Representative

Electrical QA Representatives (for organizations that utilize them) shall:

a. Inspect electrical installations as covered by the NEC;
b. Whenever any installation subject to inspection is covered or concealed, be authorized to require that such work be exposed for inspection;
c. Keep records of all electrical inspections, including dates of such inspections, findings, and a summary of violations, and a record of final disposition of violations. Periodically turn over all such records to Code 220;
d. Verify that electrical systems are either disconnected or placed in an electrically safe work condition as required by GPR 1700.5; and
e. Require that safe work practices be followed at all times.

1.12 Qualified Persons (as defined by NFPA 70E) shall be responsible for performing electrical work safely by assessing and controlling hazards and by adhering to safety-related work practices in accordance with NFPA 70E. Responsibilities include:

a. Maintaining qualification by participating in electrical safety and Arc Flash training as described in this document;

b. Reviewing the scope of work, developing the hazard analysis, and determining hazard mitigation techniques for each assigned work task;
c. Develop EEWPs if their equipment must remain energized;
d. Using required PPE appropriately;
e. Stopping work immediately or excusing themselves from a job when an operation is perceived to be imminently hazardous or if they do not believe they possess the competency to perform the work safely;
f. Informing an immediate supervisor of any electrical task or deficiency that exceeds the worker's resources, competency, or level of authority;
g. Maintaining an approved copy of the EEWP at the work site when energized work is being performed; and
h. Immediately report all close calls and mishaps to their supervisor.

2 QUALIFICATIONS

2.1 Qualified Persons

Qualifications shall meet those specified in OSHA 29 CFR 1910.332, NFPA 70E and Section 3 of this document.

2.2 Electrical Safety Officer

An ESO shall be a person designated by their organization to oversee the electrical safety program within their work area. This person should have knowledge of the applicable electrical/electronic safety requirements, or have access to subject matter experts who possess that knowledge.

2.3 Electrical Quality Assurance Representative

An Electrical QA Representative shall be a Qualified Person knowledgeable of applicable electrical safety requirements, as well as experience with the NEC, and GSFC electrical design standards.

3. TRAINING REQUIREMENTS

Qualified Persons shall be trained and experienced in the work methods required by their electrical work assignments and shall have safety training, including Arc Flash training if applicable, on the operation of the equipment and the use of safe work practices per OSHA 29 CFR 1910.332.

3.1 Technical training commensurate with the assignments of the Qualified Person shall be documented and shall meet the requirements of their job description. Refresher technical training shall be taken as required by the qualified person's job assignments and certification requirements.

3.2 An individual who is undergoing on-the-job technical training shall be under the direct supervision of a Qualified Person. This individual shall complete safety training on the hazards involved prior to performing the work.

3.3 The degree of training necessary shall be determined by their supervisor based on the work to be performed and the risk to the employee. Training for Qualified Persons shall include, but not be limited to, the following:

a. The safety-related electrical work practices pertinent to the equipment or job at hand;
b. The required procedures on how to perform jobs safely and properly;
c. The use, care, and limitations of the PPE necessary to perform jobs safely and properly;
d. The skills and techniques necessary to distinguish exposed energized parts from other parts of electrical equipment;
e. The skills and techniques necessary to determine the nominal voltages, currents, power levels, and energy levels of exposed energized parts; and
f. The minimum approach distances, flash protection boundaries, and the corresponding voltages to which the qualified person could be exposed when working on energized electrical systems.

	Required Training	**Type and Frequency**	
		Initial	***Every 3 Years**
Qualified Persons	• NFPA 70E • Arc Flash • Low Voltage Safety • High Voltage Safety • Lockout/Tagout • Confined Space Entry (if applicable) • Job Specific Tasks* • First Aid/CPR	Comprehensive	Refresher

**** Task specific refreshers shall also be conducted if there is change to a process, system or equipment.***

Table 1

4. SAFE ELECTRICAL SYSTEM REQUIREMENTS

4.1 Mitigating Electrical Hazards

Employees performing electrical work where any person might be exposed to live parts shall put these parts in an electrically safe work condition as determined by the appropriate ESO before beginning work unless it can be demonstrated that de-energizing the systems introduces additional or increased hazards.

Where equipment or systems cannot be placed into an electrically safe condition and the work must be done with a circuit energized, an EEWP shall be submitted and approved prior to the start of the work. See Section 4.2.

Exemption: EEWPs are not normally required for routine tasks performed on or near live parts such as testing, troubleshooting, and voltage measuring of electrical systems to include flight hardware and associated flight ground support equipment. If there is a question as to whether the scope of work is "routine" the organization will contact the Safety Office for guidance. These activities are exempt from an EEWP provided that such work is performed by a Qualified Person and that the appropriate safe work practices and PPE are utilized in accordance with NFPA 70E.

Where equipment or systems are placed into an electrically safe condition, the lockout/tagout requirements of GPR 1700.5 shall be met.

An electrically safe workplace shall be ensured by:

a. Implementing electrical safety requirements during construction, modification, maintenance, and utilization, including research and development (R&D) activities, of GSFC facilities and equipment;
b. Establishing training programs for electrical workers to meet the qualification requirements and to implement safety-related work practices;
c. Promoting electrical safety awareness at the workplace;
d. Complying with the most recent OSHA and other applicable electrical regulations and standards;
e. Continuously reducing the quantity and severity of electrical safety incidents, injuries and close calls; and
f. Meeting the requirements of NFPA 70E for an Electrical Safety Program.

4.2 Energized Electrical Work Permit (EEWP)

Per NFPA 70E, Section 130.1, EEWPs (GSFC Form 23-83) shall be required for work on or near exposed energized electrical equipment and systems that do not fit the profile of tasks described in the exemption in Section 4.1. If there is no reasonable method of obtaining an outage, or de-energizing the equipment, then the following requirements shall apply:

a. The EEWP shall be initiated by the organization that requires the electrical work be performed while energized.
b. The EEWP shall include an electrical hazard assessment, by a Qualified Person who would perform the work, of the specific electrical hazards associated with each task or activity. The electrical hazard assessment shall include all the elements listed in NFPA 70E, Section 130.1 (A)(2).
c. The EEWP shall be approved by the qualified person, their supervisor, and the appropriate ESO, with final approval resting with the Codes' Director Of (or a designee).
d. Unexpected (non-routine) and off-hour and emergency energized electrical work may be approved by the on-site cognizant supervisor in order to facilitate abating the immediate hazard. After the work has been a performed, an EEWP shall be completed at the earliest opportunity to justify the decisions made for working energized.
e. Completed EEWPs shall be maintained by the ESO and a copy provided to the Safety Office for retention.
f. Two Person Rule for all energized work that requires an EEWP shall be enforced.

4.3 Temporary Wiring

a. Temporary electrical wiring shall be permitted during emergencies, tests, experiments, developmental work, maintenance and repair not to exceed 120 days without Safety Office approval.
b. Temporary electrical wiring shall not be run directly on ungrounded conductive surfaces but shall be supported by suitable wood or other insulating materials.
c. Temporary electrical wiring and portable electrical cords shall be kept out of water at all times unless the cable is approved by the NEC for that purpose.
d. Temporary electrical wiring shall be removed immediately upon completion of construction, or the purpose for which the wiring was installed.

4.4 Extension Cords

NEC Article 400.8. "Flexible Cords and Cables," and Article 590, "Temporary Installations" do not permit flexible cords and cables to used as a substitute for permanent building wiring. Use of extension cords and relocatable multiple outlet power strips are to be used in a manner compatible with a Nationally Recognized Testing Laboratory (NRTL), for example, Underwriters Laboratory and Factory Mutual rating and listing. They shall not be used in a manner that substitutes for the installation of permanent building branch circuits.

a. Extension cords usage shall abide by the restrictions for temporary wiring as delineated in Section 4.3. Note: A surge protector power strip is a special type of extension cord intended to protect computers and related office equipment from damaging power fluctuations. They may be used indefinitely;
b. Where extension cords are utilized, they shall not be:
    1. Used as a substitute for the fixed wiring of a structure;
    2. Routed through holes in walls, doorways, under rugs/carpet, windows, ceilings, floors, or attached to building surfaces;
c. High-current equipment (5 amps or greater), e.g., microwave ovens, refrigerators, space heaters, coffee pots, etc., shall not be plugged directly into a power strip/surge protector;
d. Extension cords used in outdoor or wet locations shall utilize integral or separate Ground Fault Circuit Interrupters (GFCIs) for shock protection.

4.5 Shock and Flash Hazards

Hazards associated with shock and flash shall be mitigated in compliance with NFPA 70E sections 130.2 (shock) and 130.3 (flash). Results of any shock or flash analysis shall be included as part of the EEWP.

4.6 Labeling of Electrical Equipment

Labeling of electrical equipment shall be in accordance with NFPA70E.

5. ELECTRICAL SAFETY PROGRAM DOCUMENTATION

5.1 Documented Procedures. External organizations and contractors performing electrical work at GSFC shall have, and work in accordance with, a written Electrical Safety Program that utilizes the guidance in Appendix E of NFPA 70E and establishes policies, processes, and procedures applicable to their particular activities, projects or contracts. The document shall be controlled such that it is kept up to date, and revision or version control shall be exercised to ensure the latest version is in use. The following lists of topics are general and are not all inclusive. They should be addressed as appropriate depending on the types and categories of electrical work performed.

1) Electrical Safety and Approval Process
2) Electrical Hazards (medium-high)
3) Controls for Electrical Work and Electrical Equipment
4) Work on Electrical Components and Systems
5) Work Clearances and Illumination
6) Temporary Wiring
7) Extension Cords
8) Ground Fault Circuit Interrupters
9) Portable Electric Tools Equipment and Instruments
10) Equipment Grounding
11) Unknown Electrical Hazards (e.g., penetrations)
12) De-Energized Electrical Work
13) Personal Protective Equipment
14) Welding, Cutting, or Burning
15) Lockout/Tagout Procedure
16) Confined Space Entry
17) Work > 600 Volts and Protective Grounding
18) Underground Utilities and Operations
19) Energized Cables in Manholes
20) Cutting and Splicing Power Cables
21) Racking Medium and HV Circuit Breakers
22) HV Switching
23) Working Space Around Equipment
24) Cranes, Lifting Equipment, and Ladders (fixed/portable) Adjacent to Exposed Energized Parts
25) Initial Energization of Electrical Systems Above 600 Volts
26) Infrared (IR) Thermography
27) Work in Energized Substations

5.2 Facility Electrical System Drawings

5.2.1 Drawing Control. Facility Drawings shall be controlled and updated by FMD in accordance with the following requirements. Note this does not apply to flight project related equipment or sub-systems.

a. It shall be the responsibility of the organization preparing facility associated design drawings to initiate action to document changes to the drawings described in the following paragraphs. In the

event that changes are made to the systems and drawings are not produced prior to the changes, the organization performing the work shall be responsible for preparing drawings of such detail that the information can be entered onto the record drawings. Such updates shall be provided to FMD for incorporation into the building drawings.

b. It is the intent that all building drawings and diagrams be updated to the "as-built" configuration. As projects and system modifications occur, drawings shall be updated to reflect the "as-built" configuration. Information should be field verified for accuracy prior to implementing any design changes.

c. No changes shall be made to drawings without the approval of FMD.

5.2.2 TYPES OF DRAWINGS

The following types of drawings shall be maintained by FMD:

a. Low voltage and high voltage diagrams for each building and substation;
b. Protective relaying diagrams for GSFC substations;
c. Underground utility drawings, including the locations of underground electrical utilities; and
d. Record Drawings for GSFC facilities including floor plans, equipment location plans, system schematics, and/or elementary wiring diagrams. Note: Does not include special purpose/test facilities.

5.3 Drawing Accessibility

Hardcopies of the Electrical Systems Drawings are available from FMD and are provided to organizations performing work on electrical systems at GSFC on an as-needed basis.

CHANGE HISTORY LOG

Revision	Effective Date	Description of Changes
Baseline	01/12/2009	Initial Release
A	11/10/2010	Administratively Revised to update the Responsible Office Code, Organization Title and organization name within the document.
A	11/25/2013	Administratively extended for 1 year.
A	01/07/2015	Administratively extended for 1 year.
A	01/07/2016	Administratively Changed and Extended to update the Responsible Office Code, Organization Title and organization name throughout document. Also extended for 1 year.